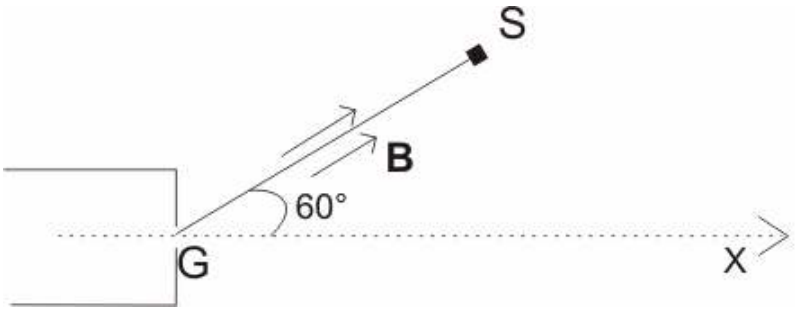
Magnetic Field and Magnetic effects of current
Assignment 2

Question 1- A current of 10A is flowing from east to west in a long wire kept in east-west direction. Find the magnetic field in a horizontal plane at a distance of (1) 10cm north (2) 20cm south from the wire; and in a vertical plane at a distance of (3) 30cm downward (4) 50cm upward.

Question 2- A short conductor of length 4cm is placed parallel to the long conductor of length 2m near to its centre at a distance of 2cm. The conductor carry currents of 2A and 5A respectively in opposite directions. Find the total force exert on the long conductor.

Question 3- An electron-gun G emit electron of energy 2KeV travelling in the positive X-direction. The electron are required to hit the spot S where GS= 0.1m, and the line GS makes an angle of 60^0 with X-axis, as shown in the figure. A uniform magnetic field **B** parallel to GS exist in the region outside the electronic-gun. Find the minimum value of B needed to make the electron hit S.
Given: $m_e = 9.1\times10^{-31}\,\text{kg}$, $e = 1.6\times10^{-19}\,\text{C}$.



Question 4- A particle of mass $1\times10^{-26}\,\text{kg}$ and charge $+1.6\times10^{-19}\,\text{C}$ travelling with velocity of $1.28\times10^{6}\,\text{m/s}$ in +x direction enters a region having electric field E and a uniform magnetic field B such as $E_x = E_y = 0$, $E_z = -102.4\,\text{kV/m}$ and $B_x = B_z = 0$, $B_y = 8\times10^{-2}\,\text{Wb/m}^2$. The particle enters this region at a long time t=0. Determine the location (x, y and z co-ordinates) of the particle at $t = 5\times10^{-6}\,\text{s}$. If the electric field switched off at this instant (with the magnetic field still present), what will be the position of the particle at $t = 7.46\times10^{-6}\,\text{s}$.

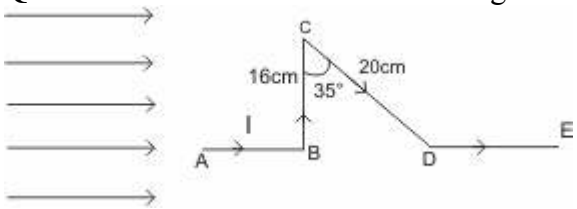
Question 5- In a certain region surrounding the origin of the coordinates, $B = 5\times10^{-4}a_z\,\text{T}$ and $E = 5a_z\,\text{V/m}$. A proton ($q_p = 1.602\times10^{-19}\,\text{C}$, $m_p = 1.6\times10^{-27}\,\text{kg}$) enters in the field at the origin with a velocity $u_0 = 2.5\times10^{5}a_x\,\text{m/s}$. Describe the proton's motion and give its position after three complete revolutions.

Question 6- Find an expression for magnetic field at the centre of a circular current carrying loop.

Question 7- A current of 1.0 A is flowing in the sides of an equilateral triangle of sides 4.5 x 10^{-2}m. Find the magnetic field at the centroid of the triangle.

Question 8- A charge $q = 40\mu C$ moves with instantaneous velocity $u = (5\times10^4)\mathbf{j}\,m/s$ through the uniform fields $E = (6\times10^4)(0.52\mathbf{i} + 0.56\mathbf{j} + 0.645\mathbf{k})V/m$ $B = (1.7)(0.693\mathbf{i} + 0.6\mathbf{j} + 0.4\mathbf{k})T$ find the magnitude and direction of the instantaneous force on q.

Question 9- Find the force on each segment of the wire as shown below in the figure



if B=0.15T. Assume that the current in the wire is 5A.

Question 10- A planar coil of 12 turns carries 15A. The coil is oriented with respect to the uniform magnetic field B=0.**2i**+0.3**j**-0.4**k** T such that its directed area is A=0.04**i**-0.05**j**+0.07**k** m^2. Find (a) the dipole moment of the coil (b)the potential energy of the in the given orientation, and (c)the angle between the positive normal to the coil and the field.